Lightweight Inflatable Structural Airlock (LISA)

CFD Research Corporation

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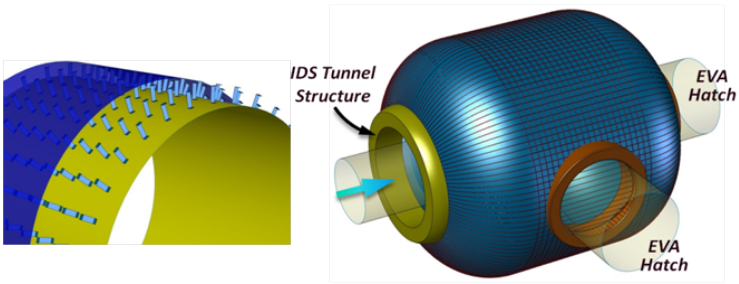
OBJECTIVES

The overall objective of this effort is to design, fabricate, and test a Lightweight Inflatable Structural Airlock (LISA) design that employs unique fabric architecture capable of delivering the lowest mass, packed volume configuration, and greatest versatility of any competing design. This effort seeks an integrated solution to address the need for expandable axial and circumferential distention of the airlock as it transitions from pressurized to unpressurized states. Phase I effort focuses on conceptual design of the airlock system, identification and evaluation of candidate materials, system characterization, fabrication of numerous test articles and a small-scale prototype, and feasibility demonstration of the airlock system.



The Proposed Integrated Lightweight Inflatable Airlock Structure with Pneumatic Distension Mechanism

ACCOMPLISHMENTS

NOTABLE DELIVERABLES PROVIDED

A subscale UHPV-based Lightweight Inflatable Structural Airlock hardware prototype item was fabricated and demonstrated. The inflatable airlock with its associated distension mechanism was developed to meet the manned safety requirements without overdesign. The single inflatable architecture includes several bulkheads around the perimeter that serve as exit and entrance ports for crew personnel as well as an attachment interface with a habitat. Computational analysis was conducted to characterize the design under different inflation and environmental conditions and provide the response characteristics to fine tune the details of the airlock design and its integration with the habitat. Candidate materials were identified to determine the best materials to use for strength and stiffness.

KEY MILESTONES MET

1. Identification of system requirements and requirements for design integration with other space habitats.
2. Design development with distension mechanisms and ingress/egress ports bulkheads around the perimeter for astronauts & an attachment interface with a habitat.
3. Identification and evaluation of candidate materials for airlock design.
4. Hardware build and demonstration.

FUTURE PLANNED DEVELOPMENTS

PLANNED POST-PHASE II PARTNERS

CFDRC will collaborate with NASA and system integrators to transition the technology to applicable NASA programs for future space explorations by a) building and testing a prototype for potential space mission and habitats applications b) integrating a prototype into an ISS for systems demonstration. NASA Phase II Enhancement/eXpanded opportunities will be leveraged to support our activities.

PLANNED/POSSIBLE MISSION INFUSION

This technology has the potential to significantly reduce the mass and packaging volume of virtually all space airlock systems, creating opportunities for expanded missions, improved performance and reduced cost. Near term programs targeted for infusion include NASA's Minimalistic Advanced Soft Hatch (MASH), Exploration Augmentation Module (EAM), and Evolvable Mars Habitation Systems programs.

PLANNED/POSSIBLE COMMERCIALIZATION

Inflatable structures for manned flight habitats, lunar surface habitation and rover vehicles, large-scale space hangars for on-orbit assembly, high altitude and heavy cargo airships, inflatable space telescopes, inflatable aerodynamic decelerators, antenna reflectors, cryogenic propellant tanks, debris shields, rescue vehicles, and barometric chambers

CONTRACT (CENTER)	NNX15CL38P (LaRC)	**SOLICITATION-PHASE**	SBIR 2015-I
SUBTOPIC	H5.01 Deployable Structures	**TA**	6.1.4 Habitation

TRL

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